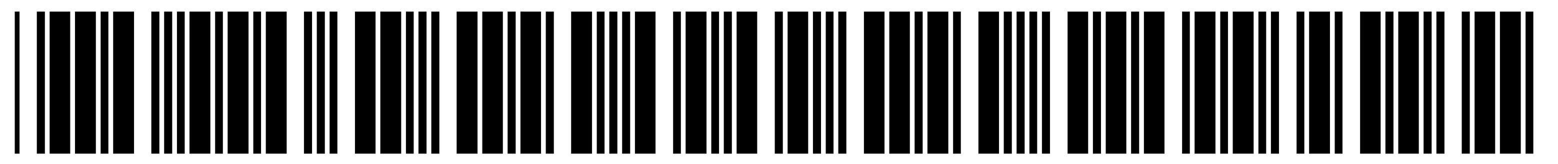

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Chiu et al.

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[45] **Date of Patent: Nov. 23, 1999**

[54] **THERMAL BUS BAR DESIGN FOR AN ELECTRONIC CARTRIDGE**

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[52] **U.S. Cl.** **257/706**; 257/723; 257/678

[58] **Field of Search** 257/706, 675, 257/685, 686, 713, 720, 723, 777, 796, 678, 718, 719, 726, 727, 724; 361/676, 688, 702, 709, 711, 679

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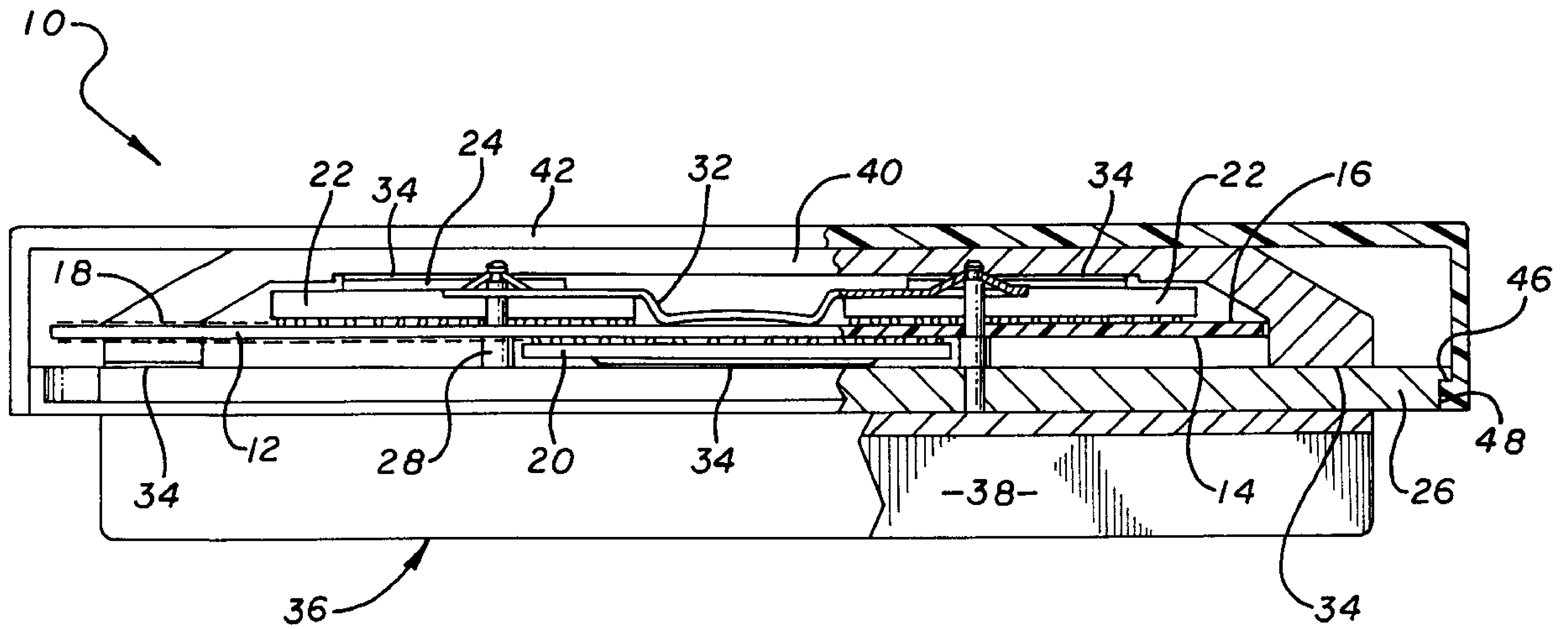
[57] **ABSTRACT**

One embodiment of the present invention is an electronic assembly which may have a first integrated circuit package mounted to a first side of a substrate and a second integrated circuit package mounted to a second side of the substrate. A thermal plate may be thermally coupled to the first integrated circuit package. A heat sink may be mounted to the thermal plate. A thermal bus may be is thermally coupled to the second integrated circuit package and the thermal plate. The thermal bus bar allows heat to flow from the second integrated circuit package to the thermal plate and heat sink. The electronic assembly of the present invention can thus remove heat from integrated circuit packages located on both sides of a substrate with only one heat sink.

15 Claims, 2 Drawing Sheets



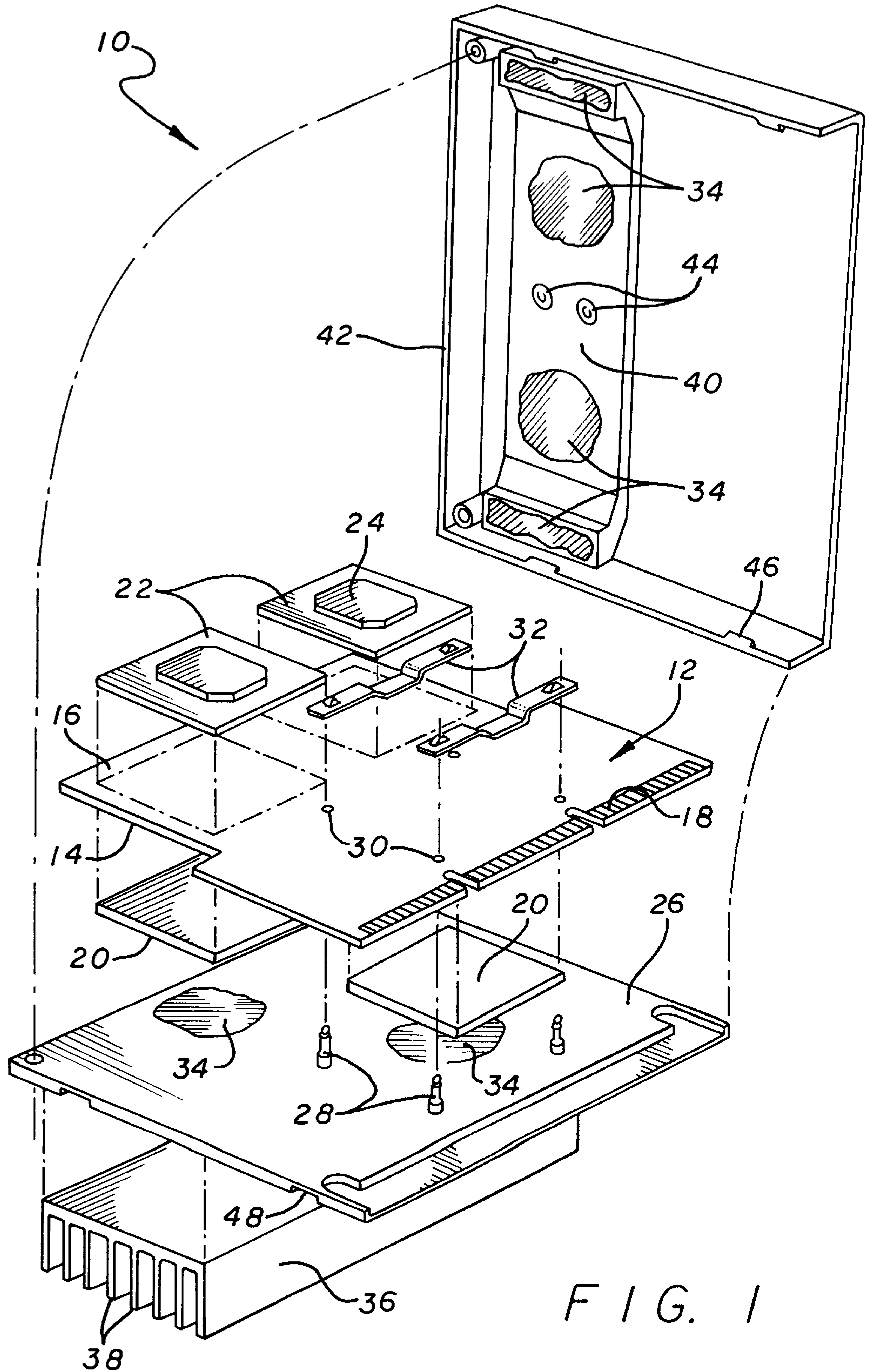


FIG. 1

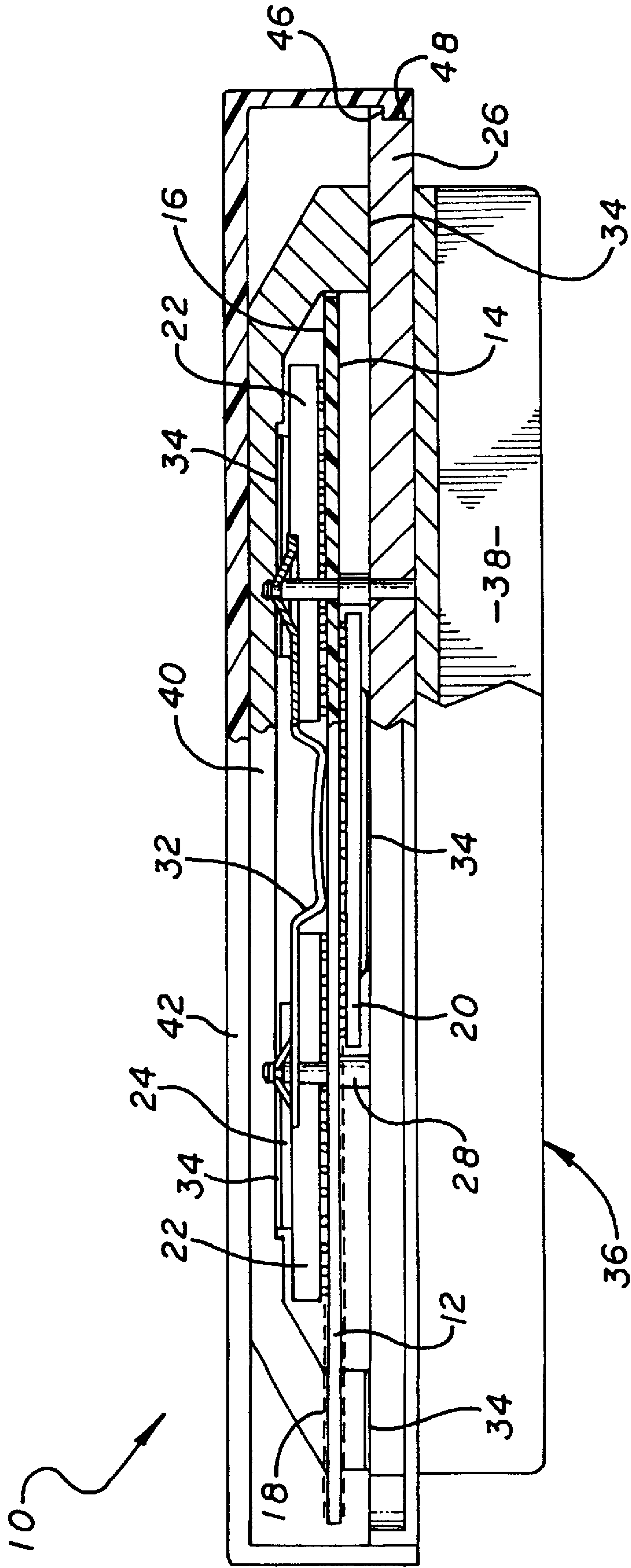


FIG. 2

THERMAL BUS BAR DESIGN FOR AN ELECTRONIC CARTRIDGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electronic assembly.

2. Background Information

Integrated circuits are typically assembled into a package that is mounted to a printed circuit board. The printed circuit board may have an electrical connector which mates with a corresponding connector located on a motherboard.

The integrated circuits generate heat which must be removed from the package. The heat must be removed in a manner which maintains the junction temperatures of the integrated circuits below a threshold level.

Some printed circuit board assemblies incorporate thermal plates and heat sinks which efficiently transfer heat from the integrated circuits. The heat sink is typically mounted to a side of the printed circuit board which contains the integrated circuit(s) that generates the largest amount of heat.

Some printed circuit board assemblies contain integrated circuit packages which are mounted on both sides of the board. Effectively removing heat from both sides of the printed circuit board may require two separate heat sinks located on each side of the board. The additional heat sink will increase the weight, size and cost of the circuit board assembly. It would be desirable to provide an electronic assembly which has a single heat sink and can effectively remove heat from integrated circuit packages mounted on both sides of a printed circuit board.

SUMMARY OF THE INVENTION

One embodiment of the present invention is an electronic assembly which may have a first integrated circuit package mounted to a first side of a substrate and a second integrated circuit package mounted to a second side of the substrate. A thermal plate may be thermally coupled to the first-side integrated circuit package. A thermal bus bar may be thermally coupled to the second-side integrated circuit package and the thermal plate.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of an embodiment of an electronic assembly of the present invention;

FIG. **2** is a bottom cross-sectional view of the electronic assembly shown in FIG. **1**.

DETAILED DESCRIPTION OF THE INVENTION

One embodiment of the present invention is an electronic assembly which may have a first integrated circuit package mounted to a first side of a substrate and a second integrated circuit package mounted to a second side of the substrate. A thermal plate may be thermally coupled to the first integrated circuit package. A heat sink may be mounted to the thermal plate. A thermal bus bar may be thermally coupled to the second integrated circuit package and the thermal plate. The thermal bus bar allows heat to flow from the second integrated circuit package to the thermal plate and the heat sink. The electronic assembly of the present invention can thus remove heat from integrated circuit packages located on both sides of a substrate with only one heat sink.

Referring to the drawings more particularly by reference numbers, FIGS. **1** and **2** show an embodiment of an elec-

tronic assembly **10** of the present invention. The assembly **10** may include a substrate **12** which has a first side **14** and a second side **16**. The substrate **12** may be a printed circuit board which contains routing traces, power/ground planes, vias, etc. as is known in the art. One edge of the substrate **12** may include a plurality of conductive pads **18**. The conductive pads **18** can be plugged into a card edge type electrical connector (not shown) which is mounted to a motherboard (not shown). The conductive pads **18** may extend along both sides **14** and **16** of the substrate **12**.

The assembly **10** may include a number of first integrated circuit packages **20** that are mounted to the first side **14** of the substrate **12** and a plurality of second integrated circuit packages **22** that are mounted to the second side **16** of the substrate **12**. The packages **20** and **22** may each contain an integrated circuit. By way of example, one or more of the first integrated circuit packages **20** may contain a microprocessor. One or more of the second integrated circuit packages **22** may contain a memory device. Each integrated circuit package **20** and **22** may contain a metal lid **24** that is thermally coupled to the integrated circuit of the package.

The assembly **10** may include a thermal plate **26** that is thermally coupled to the first integrated circuit packages **20**. The thermal plate **26** is preferably constructed from a thermally conductive material such as aluminum or copper. The thermal plate **26** may be attached to the substrate **12** by a plurality of pins **28** that extend through corresponding substrate clearance holes **30**. The thermal plate **26** may be secured to the substrate **12** by springs **32** that are attached to the pins **28**.

The springs **32** provide a spring force which pushes the plate **26** into the metal lids **24** of the first integrated circuit packages **20**. A thermal grease **34** may be placed between the lids **24** and the thermal plate **26** to reduce the thermal impedance between the packages **20** and the plate **26**. A heat sink **36** may be mounted to the thermal plate **26**. The heat sink **36** is typically constructed from a thermally conductive material such as aluminum or copper and may include a number of fins **38** which increase the surface area of the sink **36** and the heat transfer rate from the assembly **10**.

The assembly **10** may include a thermal bus bar **40** that is thermally coupled to the second integrated circuit packages **22** and the thermal plate **26**. A thermal grease **34** may be placed between the bus bar **40** and the lids **24** of the packages **22**. Likewise, thermal grease **34** may be placed between the bus bar **40** and the thermal plate **26**. Although a thermal grease **34** is shown and described, it is to be understood that the grease may be replaced by a thermal epoxy, a thermal tape, or other thermally conductive interface material.

The thermal bus bar **40** may be attached to a cover **42** that encloses the second side **16** of the substrate **12**. The cover **42** is preferably constructed from a lightweight plastic material. The cover **42** may have studs **44** which extend through corresponding holes of the bus bar **40**. The studs **44** may attach the bus bar **40** to the cover **42**. The cover **42** may be attached to the thermal plate **26** by tabs **46** that are inserted into slots **48** of the plate **26**. Attachment of the cover **42** to the plate **26** may push the bus bar **40** into the lids **24** of the second integrated circuit packages **22**.

The thermal bus bar **40** is typically constructed from a thermally conductive material such as aluminum or copper. The thermal bus bar **40** provides a conductive path from the second integrated circuit packages **22** to the thermal plate **26** and the heat sink **36**. Incorporating a bus bar **40** creates an electronic assembly **10** wherein heat can flow to a single heat

sink **36** from integrated circuit packages **20** and **22** located on both sides **14** and **16** of a substrate **12**.

While certain exemplary embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that this invention not be limited to the specific constructions and arrangements shown and described, since various other modifications may occur to those ordinarily skilled in the art.

What is claimed is:

1. An electronic assembly, comprising:

a substrate which has a first side and a second side;

a first integrated circuit package mounted to said first side of said substrate, said first integrated circuit package having a top surface;

a thermal plate coupled to said top surface of said first integrated circuit and located adjacent to said first side of said substrate;

a second integrated circuit package mounted to said second side of said substrate, said second integrated circuit package having a top surface; and,

a thermal bus bar coupled to said top surface of said second integrated circuit package and coupled to said thermal plate.

2. The assembly as recited in claim **1**, further comprising a cover that encloses said second side of said substrate.

3. The assembly as recited in claim **1**, wherein said substrate has a plurality of conductive pads located along an edge of said substrate.

4. The assembly as recited in claim **1**, further comprising a thermal grease located between said thermal plate and said thermal bus bar.

5. The assembly as recited in claim **1**, further comprising a thermal grease located between said thermal plate and a lid of said first integrated circuit package.

6. The assembly as recited in claim **1**, wherein said thermal plate is attached to said substrate.

7. The assembly as recited in claim **1**, further comprising a heat sink that is mounted to said thermal plate.

8. The assembly as recited in claim **1**, wherein said first integrated circuit package contains a microprocessor and said second integrated circuit package contains a memory device.

9. The assembly as recited in claim **2**, wherein said cover is attached to said thermal bus bar.

10. An electronic assembly, comprising:

a substrate which has a first side and a second side, said substrate having a plurality of conductive pads that are located along an edge of said substrate;

a first integrated circuit package mounted to said first side of said substrate;

a thermal plate coupled to said first integrated circuit and located adjacent to said first side of said substrate;

a second integrated circuit package mounted to said second side of said substrate;

a cover located adjacent to said second side of said substrate;

a thermal bus bar coupled to said second integrated circuit package and thermally coupled to said thermal plate; and,

a heat sink mounted to said thermal plate.

11. The assembly as recited in claim **10**, wherein said cover is attached to said thermal bus bar.

12. The assembly as recited in claim **11**, further comprising a thermal grease located between said thermal plate and said thermal bus bar.

13. The assembly as recited in claim **12**, further comprising a thermal grease located between said thermal plate and a lid of said first integrated circuit package.

14. The assembly as recited in claim **13**, wherein said thermal plate is attached to said substrate.

15. The assembly as recited in claim **14**, wherein said first integrated circuit package contains a microprocessor and said second integrated circuit package contains a memory device.

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